

IN THE CLAIMS

1. (presently amended) A process for the preparation of a pigment dispersion which comprises

a) a pigment surface treatment step of introducing at least one hydrophilic dispersibility-providing group onto the surface of a pigment directly and/or with the interposition of a polyvalent group to form a surface treated pigment that is self-dispersible in water and that comprises said at least one hydrophilic dispersibility-providing group in an amount of not lower than 10×10^{-6} equivalent per gram of particulate pigment,

b) a dispersion step of dispersing a surface-treated pigment obtained at said surface treatment step in an aqueous medium, wherein said dispersion step involves the dispersion of said surface-treated pigment in admixture with a wetting agent and water wherein the wetting agent is selected from the group consisting of acetylene glycols, acetylene alcohols, glycol ethers and [alkylene glycols] (C₄₋₁₀ alkyl) diols and is present in an amount that enhances a dispersion efficiency of particles of the surface-treated pigment in water, and

(c) adding a resin for providing dispersibility and/or fixability during and/or after said dispersion step to form said pigment dispersion, wherein the pigment dispersion has a liquid component comprising polyvalent metal ions in a total amount of not more than 600 ppm, wherein the dispersion step results in a dispersion having a pigment concentration of from about 5 to 50% by weight.

2. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein the surface tension at 20°C of the mixture at said dispersion step is not higher than 40 mN/m.

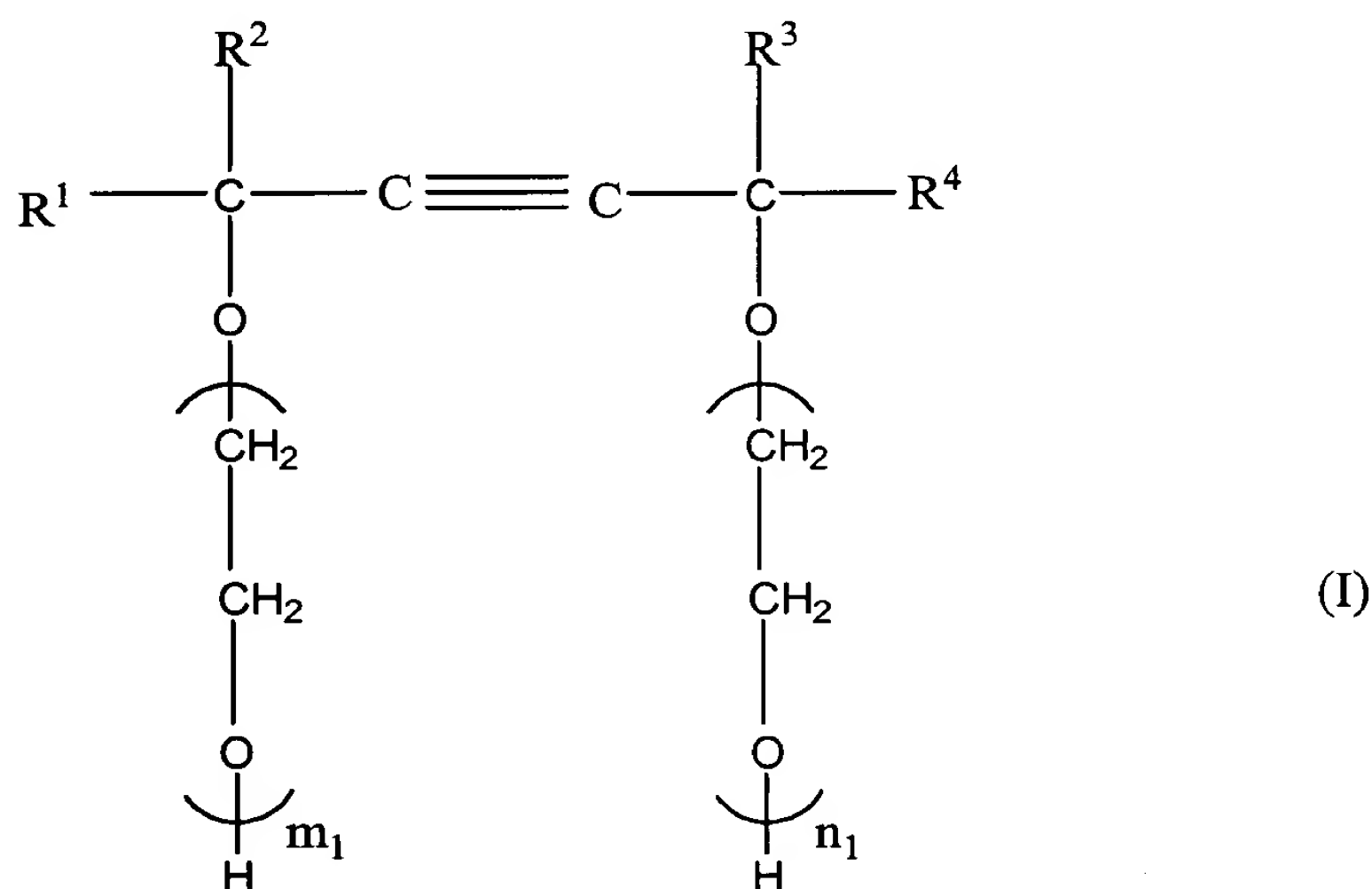
3. (canceled)

4. (canceled)

5. (Currently amended) The process for the preparation of pigment dispersion according to Claim [[4]]1, wherein the wetting agent comprises acetylene glycols and/or acetylene alcohols in an amount of from not lower than 1/50 of to twice the amount of said pigment by weight.

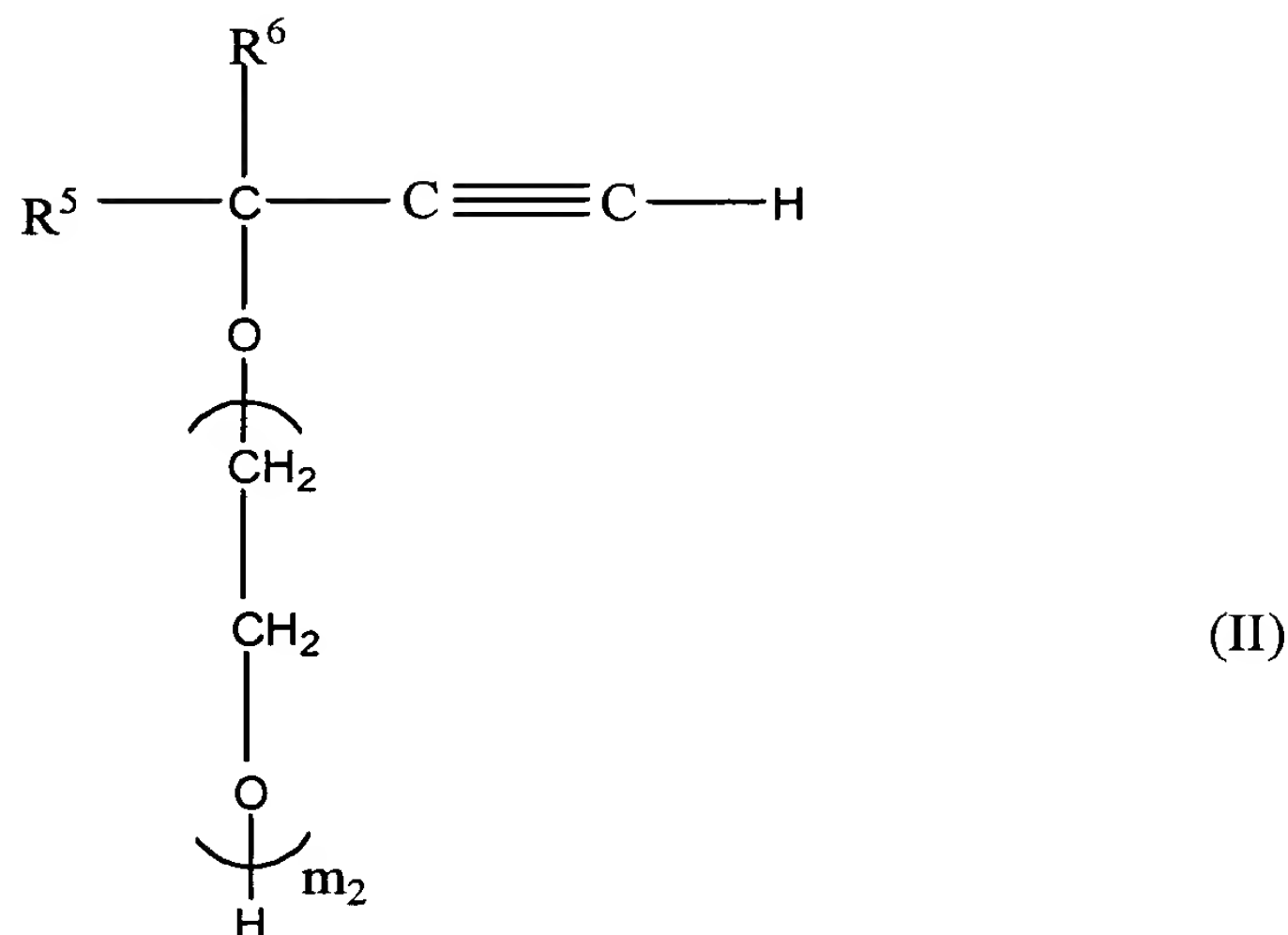
6. (Currently amended) The process for the preparation of a pigment dispersion according to Claim [[4]] 1, wherein said acetylene glycols and acetylene alcohols are compounds represented by the following general formulae (I) and (II), respectively:

[ka-1]



wherein R^1 , R^2 , R^3 and R^4 each independently represent an alkyl group; and the sum of m_1 and n_1 is from 0 to 30; and

[ka-2]



wherein R^5 and R^6 each independently represent an alkyl group; and m_2 is from 0 to 30.

7. (Previously presented) The process for the preparation of a pigment dispersion according to Claim 1, wherein said hydrophilic dispersibility-providing group to be introduced onto the surface of a pigment at said surface treatment step comprises at least one selected from the group consisting of functional groups represented by the following general formulae and salts thereof $-\text{OM}$, $-\text{COOM}$, $-\text{CO}-$, $-\text{SO}_3\text{M}$, $-\text{SO}_2\text{M}$, $-\text{SO}_2\text{NH}_2$, $-\text{RSO}_2\text{M}$, $-\text{PO}_3\text{HM}$, $-\text{PO}_3\text{M}_2$, $-\text{SO}_2\text{NHCOR}$, $-\text{NH}_3$, and $-\text{NR}_3$ in which M represents a hydrogen atom, alkaline metal, ammonium or organic ammonium; and R represents a C_{1-12} alkyl group, a phenyl group which may have a substituent or a naphthyl group which may have a substituent.

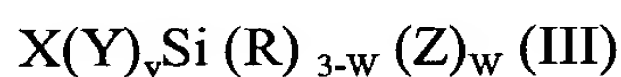
8. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said hydrophilic dispersibility-providing group to be introduced onto the surface of a pigment at said surface treatment step is a sulfur-containing dispersibility-providing group.

9. (original) The process for the preparation of a pigment dispersion according to Claim 1,

wherein the amount of said resin to be added is from not lower than 1/10 of to three times the amount of said pigment by weight.

10. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said resin comprises an alkali-soluble resin and/or a vinyl polymer obtained by the copolymerization of (a) one or more selected from the group consisting of silicon macromer represented by the following general formula (III) and acrylamide or methacrylamide-based monomer (excluding said monomer having salt-producing groups), (b) a polymerizable unsaturated monomer having a salt producing group and (c) a monomer copolymerizable with these monomers in the presence of a radical polymerization initiator:

[ka-3]



wherein X represents a polymerizable unsaturated group; Y represents a divalent connecting group; R represents a hydrogen atom, a lower alkyl group, an aryl group or an alkoxy group, with the proviso that a plurality of R's may be the same or different; Z represents a monovalent siloxane polymer moiety having a number-average molecular weight of at least about 500; v represents 0 or 1; and w represents an integer of from 1 to 3.

11. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said resin exhibits a glass transition temperature of not lower than 50°C.

12. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said resin has a weight-average molecular weight of from 1,600 to 50,000.

13. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said resin exhibits an acid value of from 10 to 250.

14. (original) The process for the preparation of a pigment dispersion according to Claim 10, wherein among said resins, the alkali-soluble resin is a styreneacrylic acid copolymer.

15. (canceled)

16. (previously presented) The process for the preparation of a pigment dispersion according to Claim 1, wherein Si, Ca, Mg, Fe, Cr and Ni ions incorporated in the liquid component of the pigment dispersion are each not higher than 100 ppm.

17. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises a carbon black pigment and/or an organic pigment.

18. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises one or more pigments selected from the group consisting of C.I. pigment red, C.I. pigment yellow, C.I. pigment violet, C.I. pigment blue, C.I. pigment orange, C.I. pigment green, and C.I. pigment brown.

19. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises one or more pigments selected from the group consisting of phthalocyanine pigment, quinacridone pigment, condensed azo pigment, isoindolinone pigment, quinophthalone pigment, anthraquinone pigment, benzimidazolone pigment, and perylene pigment.

20. (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said surface treatment step involves the introduction of a polymer material onto the surface of a pigment directly and/or with the interposition of a polyvalent group.

21. (previously presented) A pigment dispersion prepared by the process for the preparation of a pigment dispersion described in ~~[[c]]~~Claim 1.

22. (original) An ink jet recording ink at least comprising the pigment dispersion described in Claim 21.

23. (original) An ink jet recording method which comprises energizing the ink described in Claim 22 so that it is ejected from a recording head and attached to a recording medium.

24. (original) The ink jet recording method according to Claim 23, wherein said energy is a dynamic energy.

25. (original) The ink jet recording method according to Claim 23, wherein said energy is a heat energy.

26. (previously presented) A recorded material obtained by the method described in Claim 23.

27. (previously presented) The process according to claim 1, wherein the wetting agent is present in an amount of from 0.1 to 30% by weight based on the weight of the pigment dispersion in the dispersion step.

28. (canceled)

29. (canceled)

30. (previously presented) A process for the preparation of a recording liquid comprising the steps of (i) providing a pigment dispersion prepared by the process of claim 1; and (ii) subsequent to the preparation of said pigment dispersion, mixing the pigment dispersion with at least a solvent to form the recording liquid.

31. (previously presented) The process as claimed in claim 30, wherein step (ii) comprises mixing the pigment dispersion with at least the solvent, a surfactant and water to form the recording liquid.

32. (currently amended) The process as claimed in claim 31, wherein the recording liquid has a solid component comprising the surface treated pigment and resin and a liquid component comprising the wetting agent, solvent, surfactant, polyvalent metal ions and water, the solid component of the recording liquid being present in an amount by weight that is less than an amount by weight of the wetting agent, solvent, surfactant and polyvalent metal ions present ~~substituents other than water~~ in the liquid component of the recording liquid.

33. (currently amended) The process as claimed in claim 32, wherein the pigment dispersion has (i) a liquid component comprising the wetting agent, water and polyvalent metal ions and (ii) a solid component comprising the surface treated pigment and the resin, said solid component being present in the pigment dispersion in an amount by weight that is greater than a total amount by weight of ~~substituents other than water~~ the wetting agent and polyvalent metal ions present in the liquid component.

34. (previously presented) The process according to claim 33, wherein the pigment dispersion consists essentially of the surface treated pigment, the resin, the wetting agent, the polyvalent metal ions and water.

35. (previously presented) The process according to claim 33, wherein the pigment dispersion consists essentially of the surface treated pigment, the resin, the wetting agent, a neutralizing agent, the polyvalent metal ions and water.

36. (previously presented) The process according to claim 1, wherein the resin is added during said dispersion step.

37. (New) The process according to claim 1, wherein the wetting agent is selected from the group consisting of glycol ethers and (C₄₋₁₀ alkyl) diols.

38. (New) The process according to claim 1, wherein the wetting agent is a (C₄₋₁₀ alkyl) diol.

39. (New) A process for the preparation of a pigment dispersion which comprises:

(a) a pigment surface treatment step of introducing at least one hydrophilic dispersibility-providing group onto the surface of a pigment directly and/or with the interposition of a polyvalent group to form a surface treated pigment that is self-dispersible in water and that comprises said at least one hydrophilic dispersibility-providing group in an amount of not lower than 10×10^{-6} equivalent per gram of particulate pigment,

(b) a dispersion step of dispersing a surface treated pigment obtained at said surface treatment step in an aqueous medium, wherein said dispersion step involves the dispersion of said surface-treated pigment in admixture with a wetting agent and water

wherein the wetting agent is selected from the group consisting of acetylene glycols, acetylene alcohols, glycol ethers and alkylene glycols and is present in an amount that enhances a dispersion efficiency of particles of the surface-treated pigment in water, and

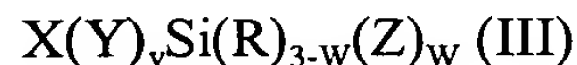
(c) adding a resin for providing dispersibility and/or fixability during and/or after said dispersion step to form said pigment dispersion, wherein the pigment dispersion has a liquid component comprising polyvalent metal ions in a total amount of not more than 600 ppm,

wherein the dispersion step results in a dispersion having a pigment concentration of from about 5 to 50% by weight; and

wherein said resin comprises a vinyl polymer obtained by the copolymerization of (a) one or more selected from the group consisting of silicon macromer represented by the following general formula (III) and acrylamide or methacrylamide-based monomer (excluding said monomer having salt-producing groups),

(b) a polymerizable unsaturated monomer having a salt producing group and (c) a monomer copolymerizable with these monomers in the presence of a radical polymerization initiator:

[ka-3]



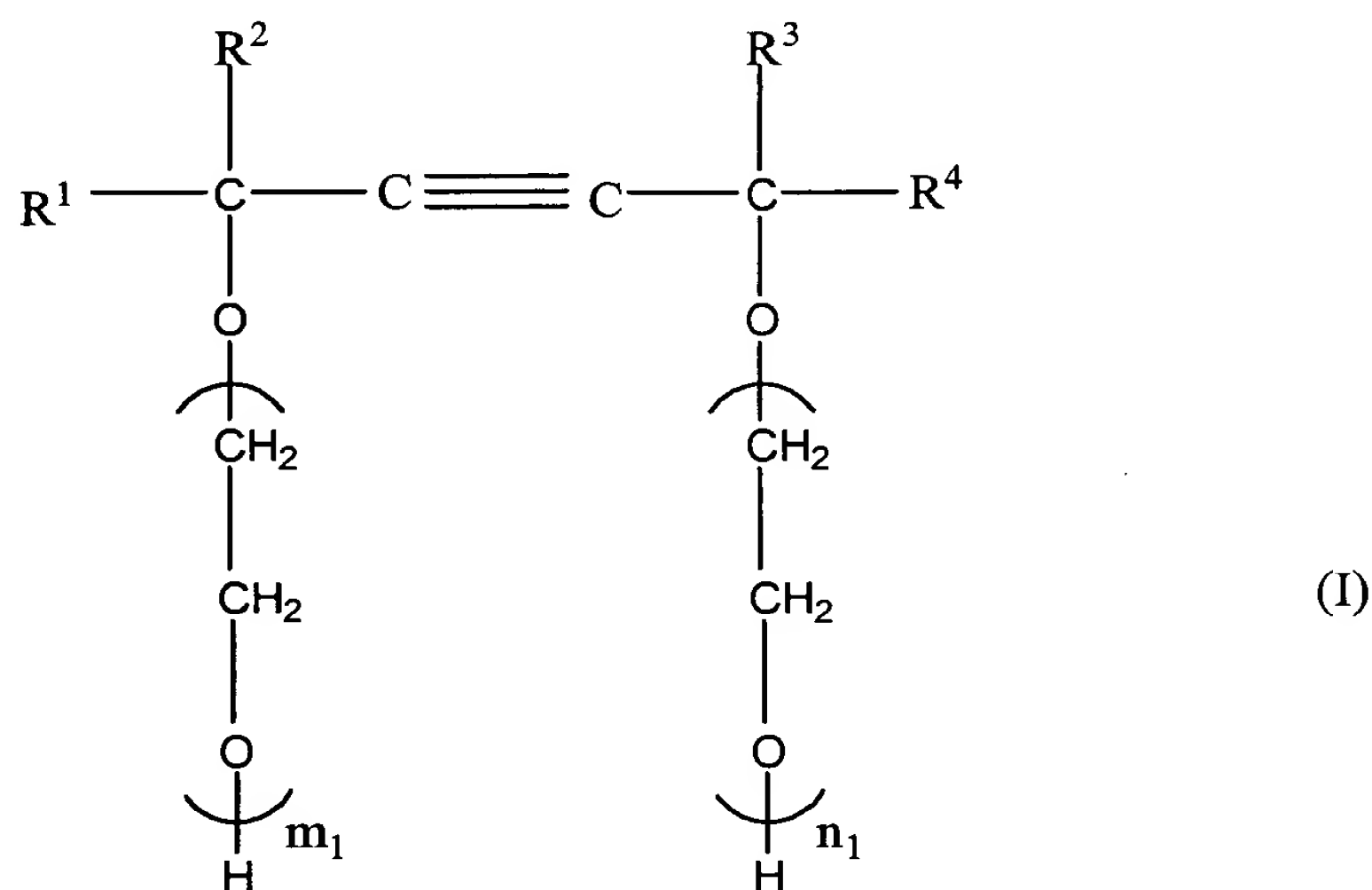
wherein X represents a polymerizable unsaturated group; Y represents a divalent connecting group; R represents a hydrogen atom, a lower alkyl group, an aryl group or an alkoxy group, with the proviso that a plurality of R's may be the same or different; Z represents a monovalent siloxane polymer moiety having a number-average molecular weight of at least about 500; v represents 0 or 1; and w represents an integer of from 1 to 3.

40. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein the surface tension at 20°C of the mixture at said dispersion step is not higher than 40 mN/m.

41. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein the wetting agent comprises acetylene glycols and/or acetylene alcohols in an amount of from not lower than 1/50 of to twice the amount of said pigment by weight.

42. (New) The process for the preparation of a pigment dispersion according to claim 41, wherein said acetylene glycols and acetylene alcohols are compounds represented by the following general formulae (I) and (II), respectively:

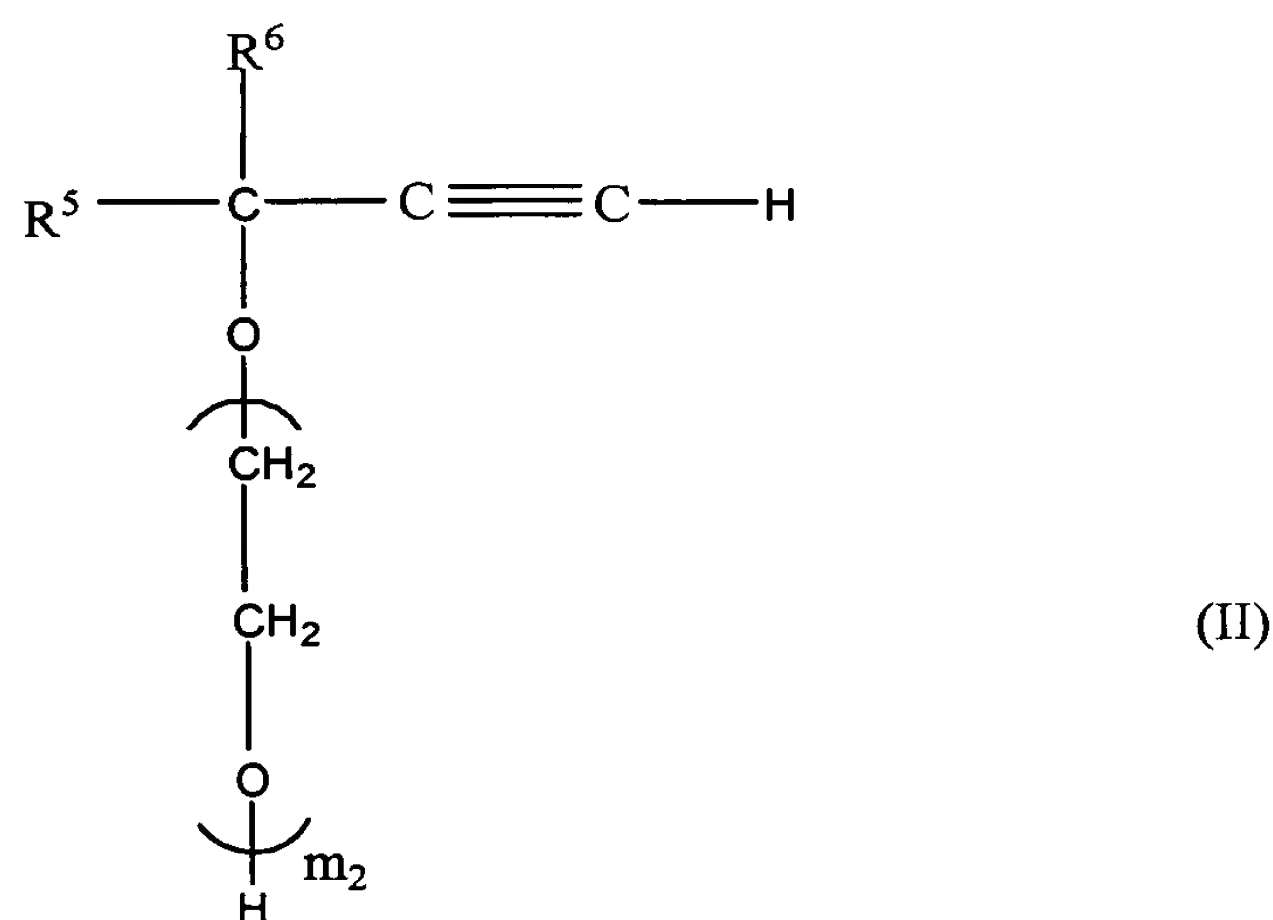
[ka-1]



wherein R^1 , R^2 ,

R^3 and R^4 each independently represents an alkyl group; and the sum of m_1 and n_1 is from 0 to 30; and

[ka-2]



wherein R^5 and R^6 each independently represents an alkyl group; and m_2 is from 0 to 30.

43. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein said hydrophilic dispersibility-providing group to be introduced onto the surface of a pigment at said surface treatment step comprises at least one selected from the group consisting of functional groups represented by the following general formulae and salts thereof $-OM$, $-COOM$, $-CO-$, $-SO_3M$, $-SO_2M$, $-SO_2NH_2$, $-RSO_2M$, $-PO_3HM$, $-PO_3M_2$, $-SO_2NHCOR$, $-NH_3$, and $-NR_3$ in which M represents a hydrogen atom, alkaline metal, ammonium or organic ammonium; and R represents a C_{1-12} alkyl group, a phenyl group which may have a substituent or a naphthyl group which may have a substituent.

44. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein said hydrophilic dispersibility-providing group to be introduced onto the surface of a pigment at said surface treatment step is a sulfur-containing dispersibility providing group.

45. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein the amount of said resin to be added is from not lower than 1/10 of to three times the amount of said pigment by weight.

46. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein said resin exhibits a glass transition temperature of not lower than 50°C .

47. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein said resin has a weight-average molecular weight of from 1,600 to 50,000.

50. (New) The process for the preparation of a pigment dispersion according to claim 39,

wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises a carbon black pigment and/or an organic pigment.

51. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises one or more pigments selected from the group consisting of C.I. pigment red, C.I. pigment yellow, C.I. pigment violet, C.I. pigment blue, C.I. pigment orange, C.I. pigment green, and C.I. pigment brown.

52. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises one or more pigments selected from the group consisting of phthalocyanine pigment, quinacridone pigment, condensed azo pigment, isoindolinone pigment, quinophthalone pigment, anthraquinone pigment, benzimidazolone pigment, and perylene pigment.

53. (New) The process for the preparation of a pigment dispersion according to claim 39, wherein said surface treatment step involves the introduction of a polymer material onto the surface of a pigment directly and/or with the interposition of a polyvalent group.

54. (New) A pigment dispersion prepared by the process for the preparation of a pigment dispersion according to claim 39.

55. (New) An ink jet recording ink at least comprising the pigment dispersion according to claim 54.

56. (New) An ink jet recording method which comprises energizing the ink according to claim 55 so that it is ejected from a recording head and attached to a recording medium.

57. (New) The ink jet recording method according to claim 56, wherein said energy is a dynamic energy.

58. (New) The ink jet recording method according to claim 56, wherein said energy is a heat energy.

59. (New) A recorded material obtained by the method described in claim 56.

60. (New) The process according to claim 39, wherein the wetting agent is present in an amount of from 0.1 to 30% by weight based on the weight of the pigment dispersion in the dispersion step.

61. (New) A process for the preparation of a recording liquid comprising the steps of:
(i) providing a pigment dispersion prepared by the process of claim 39;
and

(ii) subsequent to the preparation of said pigment dispersion, mixing the pigment dispersion with at least a solvent to form the recording liquid.

62. (New) The process as claimed in claim 61, wherein step (ii) comprises mixing the pigment dispersion with at least the solvent, a surfactant and water to form the recording liquid.

63. (New) The process as claimed in claim 62, wherein the recording liquid has a solid

component comprising the surface treated pigment and resin and a liquid component comprising the wetting agent, solvent, surfactant, polyvalent metal ions and water, the solid component of the recording liquid being present in an amount by weight of the wetting agent, solvent surfactant and polyvalent metal ions present in the liquid.

64. (New) The process as claimed in claim 63, wherein the pigment dispersion has (i) a liquid component comprising the wetting agent, water and polyvalent metal ions and (ii) a solid component comprising the surface treated pigment and the resin, said solid component being present in the pigment dispersion in an amount by weight that is greater than a total amount by weight of the wetting agent and polyvalent metal ions present in the liquid component.

65. (New) The process according to claim 64, wherein the pigment dispersion consists essentially of the surface treated pigment, the resin, the wetting agent, the polyvalent metal ions and water.

66. (New) The process according to claim 64, wherein the pigment dispersion consists essentially of the surface treated pigment, the resin, the wetting agent, a neutralizing agent, the polyvalent metal ions and water.

67. (New) The process according to claim 39, wherein the resin is added during said dispersion step.